CLAIMS

What is claimed is:

1. A method of generating an optical pulse in a gas discharge laser, comprising:

applying a main discharge voltage to a pair of main discharge electrodes in a discharge chamber of the laser in order to charge the pair of main discharge electrodes;

applying a trigger ionization voltage to an ionization element in the discharge chamber, subsequent to the charging of the pair of main electrodes; and

discharging the main discharge voltage between the main discharge electrodes in response to the applying of the trigger ionization voltage.

2. A method according to claim 1, further comprising:

timing the application of the trigger ionization voltage to occur when a maximum voltage charge exists on the pair of main discharge electrodes.

3. A method according to claim 1, wherein:

applying a trigger ionization voltage to an ionization element includes applying the trigger ionization voltage to an ionization element selected from the group consisting of ionization electrodes, corona rods, and ionization pins.

4. A method according to claim 1, further comprising:

using an ionization circuit to apply the trigger ionization voltage, the ionization circuit being electrically isolated from a discharge circuit used to apply the main discharge voltage.

5. A method according to claim 1, further comprising:

using an ionization circuit to apply the trigger ionization voltage, the ionization circuit including a high-voltage solid state switch whereby the trigger ionization is applied in response to a closing of the solid state switch.

6. A method according to claim 1, wherein:

an optical pulse is generated in the discharge chamber when the charged pair of main electrodes discharges.

7. A method according to claim 1, further comprising:

receiving an optical pulse from an oscillator chamber.

8. A method according to claim 7, further comprising:

amplifying the optical pulse in the discharge chamber when the charged pair of main electrodes discharges.

9. A method according to claim 7, further comprising:

timing the application of the trigger ionization voltage such that the discharge of the charged pair of main discharge electrodes substantially coincides with the receiving of the optical pulse.

10. A method according to claim 9, wherein:

timing the application of the trigger ionization voltage includes receiving a signal from a photodetector for the oscillator chamber, the signal indicating the emission of the optical pulse in the oscillator chamber.

11. A method according to claim 10, wherein:

timing the application of the trigger ionization voltage includes receiving a signal from an electronic control module, the signal indicating a delay for the timing of the application.

12. A method according to claim 9, wherein:

timing the application of the trigger ionization voltage includes receiving a signal from a pick off loop for the oscillator chamber, the signal indicating the application of a charging voltage to a pre-ionization unit of the oscillator chamber.

13. A method according to claim 1, wherein:

applying a trigger ionization voltage to the ionization element includes receiving a portion of an optical pulse from an oscillator chamber, the optical pulse serving to provide sufficient ionization of the energized gas mixture such that the charged pair of main electrodes discharges in the discharge chamber

14. A gas discharge laser system, comprising:

a resonator including therein a discharge chamber filled with a gas mixture and containing a pair of main electrodes connected to a pulser circuit for charging the pair of main electrode with a discharge voltage; and

an ionization circuit including an ionization element in the discharge chamber, the ionization circuit capable of supplying a trigger ionization voltage to the ionization element subsequent to the charging of the pair of main electrodes in order to provide sufficient ionization of a gas mixture in the discharge chamber such that the main electrodes discharge in the gas mixture.

15. An excimer or molecular fluorine laser system, comprising:

a master oscillator including therein a first discharge chamber filled with a first gas mixture, the first discharge chamber containing first main discharge electrodes connected to a first discharge circuit for charging the first main electrodes;

a power amplifier including therein a second discharge chamber filled with a second gas mixture, the second discharge chamber containing second main discharge electrodes connected to a second discharge circuit for charging the second main electrodes;

a first ionization circuit including a first ionization element disposed in the first discharge chamber, the first ionization circuit capable of applying a first trigger ionization voltage to the first ionization element subsequent to the charging of the first main electrodes in order to provide sufficient ionization of the first gas mixture such that the first main electrodes discharge in the gas mixture and generate an optical pulse in the first discharge chamber;

a second ionization circuit including a second ionization element in the second discharge chamber, the second ionization circuit capable of applying a second trigger ionization voltage to the second ionization element subsequent to the charging of the second main electrodes in order to provide sufficient ionization of the second gas mixture such that the second main electrodes discharge in the gas mixture and amplify the optical pulse generated by, and received from, the master oscillator; and

an electronic control module in communication with the first and second ionization circuits, the electronic control module capable of supplying a signal to each of said first and second ionization circuits in order to control a relative timing of the application of the first and second trigger ionization voltages.

16. A laser system according to claim 15, further comprising:

a common pulser circuit in communication with the master oscillator and power amplifier, the common pulser circuit including the first and second discharge circuits.

17. A laser system according to claim 15, further comprising:

a high voltage power source for providing the second trigger ionization voltage to the second ionization element.

18. An excimer or molecular fluorine laser system, comprising:

a master oscillator including therein a first discharge chamber filled with a first gas mixture, the first discharge chamber containing first main discharge electrodes connected to a first discharge circuit for charging the first main discharge electrodes to energize the first gas mixture and generate an optical pulse therein;

a power amplifier including therein a second discharge chamber filled with a second gas mixture, the second discharge chamber containing second main discharge electrodes connected to a second discharge circuit for charging the second main discharge electrodes, the second discharge chamber receiving a portion of the optical pulse in order to trigger sufficient ionization in the second gas mixture subsequent to

the charging of the second main discharge electrodes whereby the energized second gas mixture receives and amplifies the optical pulse.

19. A laser system according to claim 18, further comprising:

an optical delay line in a path of the optical pulse between the master oscillator and power amplifier such that the portion of the optical pulse is transmitted directly to the power amplifier and the remainder of the optical pulse encounters a delay, such that the electrical discharge in the gas mixture is fully developed when the remainder of the optical pulse reaches the power amplifier.